UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
CHEMICAL SAFETY AND
POLLUTION PREVENTION

MEMORANDUM:

To: Elizabeth Fertich

From: Tim Ciarlo, MS, Entomologist

Secondary Review: Kable Bo Davis, MS, Lead Biologist

Date: January 22, 2016

Subject: PRODUCT PERFORMANCE DATA EVALUATION RECORD (DER)

~~**THIS DER CONTAINS CONFIDENTIAL BUSINESS INFORMATION**~~

Note: MRIDs found to be **unacceptable** to support label claims should be removed from the data matrix.

DP barcode: Not Found
Decision no.: 441190
Submission no: 883528
Action code: 570
Product Name: RF2056 OL
EPA Reg. No or File Symbol: 2724-791
Formulation Type: RTU ULV liquid (diluted with water at lower rates)
Ingredients statement from the label with PC codes included:
Etofenprox 20% PC: 128965

Application rate(s) of product and each active ingredient (lbs. or gallons/1000 square feet or per acre as appropriate; and g/m^2 or mg/cm^2 or mg/kg body weight as appropriate): 0.00175 to 0.007 lbs etofenprox per acre for ground and aerial ULV application.

Use Patterns: RF2056 OL is an insecticide that is sprayed over agricultural crops, pasture, rangeland, industrial, urban, recreational, and woodland areas by air or ground ULV application. It can be used as packaged or diluted with water and is currently labeled to be effective against adult mosquitoes, non-biting midges, and nuisance flies.

I. Action Requested: The registrant submitted efficacy studies in 2010 to satisfy conditional data requirements identified at the time of conditional product registration. These data are reviewed for the first time in this DER.

II. Background: This product was conditionally registered 8/15/2008. Ground ULV data were reviewed at that time. Aerial ULV data would have required an EUP and so were not provided. The DER dated 2/19/2009 contains the following guidance on conditional data requirements to support label claims:

> The submitted adult mosquito data support use of the product for wide area adult mosquito control with ground ULV equipment and conditionally for aerial applications. Aerial application data are required as a condition of registration from 5 geographic areas at the lowest label rate for aerial applications. Trials should include testing against vectors from the genera *Culex*, *Anopheles* and *Aedes* at a minimum.

Efficacy data must be submitted (conditionally) to retain black flies, nuisance flies, non-biting flies, and biting flies on the label. Ground ULV data are acceptable.

a. Black flies – test against biting black fly species in Pennsylvania and/or Minnesota. And/or Maine.
b. Nuisance/Non-biting flies – test against house fly or little house fly
c. Biting flies – test against stable flies.
d. We can discuss a field test with caged lab reared individuals using a design similar to mosquito testing with ground and/or aerial ULV.

The studies reviewed here investigated aerial ULV efficacy against mosquitoes, black flies, stable flies, and non-biting midges.

III. MRID Summary:

48255301. Field Aerial Mosquito Efficacy Studies of Etofenprox in Manatee County, Florida.

(1) non-GLP.

(2) **Methods:** Non-blood fed, adult female lab reared *Aedes albopictus* and *Culex quinquefasciatus* mosquitoes were caged and placed in a square 600 ft x 600 ft field plot that was treated with 6 aerial applications of Zenivex E20, which contains 20% etofenprox. 2 applications were made at the rate of 0.00175 lbs etofenprox per acre, 2 at the rate of 0.0035 lbs etofenprox per acre, and 2 at the rate of 0.007 lbs etofenprox per acre. The same flow rate of 118 ounces per minute at 500 PSI was used in all 6 applications. BVA-13 oil was used as a diluent to achieve application rates of 0.0035 and 0.00175 lbs etofenprox per acre. A target of 20-25 mosquitoes were loaded into cages, although an exact number of individuals used per cage was not given. For each application, 2 cages were mounted on each of 16 poles in the treatment zone for a total of 32 treated cages. The poles were arranged in a 4 x 4 array (4 cages per row and 4 cages per "column") separated from each other by 200 ft. A total of 4 control cages were placed on poles in the grid and removed 30 minutes prior to the start of each application. *Ae. albopictus* mosquitoes were used only in the group receiving the 0.007 lbs per acre rate due to a limited quantity of mosquitoes.

Aerial ULV applications of Zenivex E20 were made perpendicular to the direction of the wind from a helicopter at one of three application rates mentioned above. Two applications were attempted nightly over a span of three successive nights. Cages were left in the field plot for less than 30 minutes post application before removal and transfer to clean holding cups. Mortality was at recorded at four time points, the first occurring 1 hour post treatment and the final count occurring at approximately 24 hours post treatment. Untreated control mortality was also recorded. Slide spinners at each pole measured Volume Mean Diameter (VMD) of Zenivex E20 droplets.

(3) **Results:** Results were reported in histogram form for each application. Raw data were not provided. Reported mortality 24 hours post treatment was greater than 90% in both replications for the the 0.007 and 0.0035 lbs etofenprox per acre rates. At the lowest application rate of 0.00175 lbs per acre, mortality was 91% in one replicate and 81% in the other. The reduced mortality is explainable due to less than ideal wind conditions. This field study reports mortality that is reasonably close to 90% and therefore supports efficacy claims.

VMD of Zenivex E20 particles fell within the label-specified range of 7-30 microns for each application.

(4) **Conclusion:** This study is **acceptable** and supports aerial ULV efficacy claims against *Ae. albopictus* and *Cx. quinquefasciatus* at the application rate of 0.007 lbs etofenprox per acre. Aerial ULV efficacy claims against *Cx. quinquefasciatus* are also suppored at the lower rates of 0.0035 and 0.00175 lbs etofenprox per acre. Efficacy claims against *Ae. albopictus* are not supported at these rates because they were not tested.

48255302. Efficacy Determination of Ground ULV Applications of Etofenprox against Non-biting midge.

(1) non-GLP

(2) **Methods:** Wild caught non-biting midges were used in this study (mixture of *Chironomus utahensis*, *Ch. Plumosus*, and *Glyptotendipes barbipies*). Midges were caged and placed in a 300 ft x 300 ft field plot that was

treated with three different rates of Zenivex E20, which contains 20% etofenprox. A target of 20 midges per cage was reported, although an exact number of individuals used per cage was not given. Two cages were mounted on each of nine poles in the treatment zone for a total of 18 treated cages. The poles were arranged in a 3 x 3 array separated from each other by 100 ft. One control cage was placed on each pole and removed 30 minutes prior to the start of each treatment.

ULV applications of Zenivex E20 were made from a truck-mounted sprayer travelling perpendicular to the wind direction at 20 mph 100 ft from the nearest poles in the test plot. Single applications of three different rates (0.00175, 0.0035, and 0.007 lbs of etofenprox per acre) were made on the same day in succession from lowest to highest rate. Cages were left in the field plot for 15 minutes post application before removal. Mortality was assessed 3, 12, and 24 hours after each application was made. Untreated control mortality was also recorded. Volume Mean Diameter (VMD) of Zenivex E20 droplets was measured during equipment calibration.

(3) **Results:** Mortality was reported as 96% and 90% 24 hours after treatment at the 0.00175 lbs etofenprox application rate, 50% and 96% 24 hours after treatment at the 0.0035 lbs etofenprox application rate, and 100% in both replicates 24 hours after treatment at the 0.007 lbs etofenprox application rate. Raw mortality data were not provided. Control mortality was moderate in some treatment groups, but was adjusted for using Abbott's formula. Knockdown was not reported.

VMD of Zenivex E20 particles was reported as 4.49 microns. This falls slightly outside the label-specified range of 7-30 microns.

(4) **Conclusion:** This study is **acceptable** and supports efficacy claims against non-biting midges at the rates of 0.00175, 0.0035, and 0.007 lbs of etofenprox per acre. While mortality in one replicate treated with the 0.0035 lbs etofenprox per acre rate was only 50%, wind conditions at the time of application shifted the cloud away from the test cages. Adequate mortality would be expected if the cloud had hit the treatment zone, especially because good mortality was seen at the lower rate of 0.00175 lbs etofenprox per acre. Knockdown claims are not supported because these data were not collected. Quick kill/fast kill claims are also not supported as mortality was not assessed until 2-4 hours post treatment.

48255303. Field Aerial Mosquito Efficacy Studies of Etofenprox in Churchill County, Nevada.

(1) non-GLP.

(2) **Methods:** Feral, adult female *Aedes dorsalis* mosquitoes were collected with CO_2 baited CDC light traps at the test site and used in this study. Mosquitoes were caged and placed in a square 600 ft x 600 ft field plot that was to be treated with 6 aerial applications of Zenivex E20, which contains 20% etofenprox. Due to unfavorable weather conditions for the duration of the study and inadequate application equipment, only one replication at the 0.00175 lbs etofenprox per acre application rate was successfully completed. A target of 20-25 mosquitoes were loaded into cages, although an exact number of individuals used per cage was not given. 2 cages were mounted on each of 16 poles in the treatment zone for a total of 32 treated cages. The poles were arranged in a 4 x 4 array (4 cages per row and 4 cages per "column") separated from each other by 200 ft. A total of 4 control cages were placed on poles in the grid and removed 30 minutes prior to the start of each application.

An aerial ULV application of Zenivex E20 was made perpendicular to the direction of the wind from a fixed-wing aircraft. Cages were left in the field plot for less than 30 minutes post application before removal and transfer to clean holding cups. Mortality was at recorded at four time points, the first occurring 1 hour post treatment and the final count occurring at approximately 24 hours post treatment. Untreated control mortality was also recorded. Slide spinners at each pole measured Volume Mean Diameter (VMD) of Zenivex E20 droplets.

(3) **Results:** Results were reported in histogram form. Raw data were not provided. Reported mortality 24 hours post treatment was 70% at the lowest application rate of 0.00175 lbs per acre. The low mortality observed is explainable due to less than ideal wind conditions. Additionally, the flat-fan nozzles used were inappropriate for aerial ULV application and therefore failed to deliver an adequate number of droplets at the correct VMD to the test cages. Due to limitations in study execution, this study is supplemental and does not support efficacy claims.

VMD of Zenivex E20 particles was 35 microns, which is outside the label-specified range of 7-30 microns for each application.

(4) **Conclusion:** Due to severe limitations in study execution and inadequate mortality, this study is **supplemental** and does not support ULV efficacy claims against *Ae. dorsalis* at the tested application rate of 0.00175 lbs etofenprox per acre.

48255304. Field Aerial Mosquito and Stable Fly Efficacy Studies of Etofenprox in Hamilton County, Iowa.

*Review of this MRID is divided between mosquitoes and stable flies.

(1) non-GLP.

(2) **Methods: (Stable Flies)** Stable flies (*Stomoxys calcitrans*) were caged and placed in a square 600 ft x 600 ft field plot that was treated with two applications (treatment replications) of Zenivex E20, which contains 20% etofenprox, at the rate of 0.00175 lbs etofenprox per acre. A target of 15 adult stable flies per cage was reported, although an exact number of individuals used per cage was not given. For each application, one cage was mounted on each of 16 poles in the treatment zone for a total of 16 treated cages (a total of 32 replicates for this label rate). The poles were arranged in a 4 x 4 array (4 cages per row and 4 cages per "column") separated from each other by 200 ft. One control cage was placed on each pole and removed 30 minutes prior to the start of each treatment. The number of control cages used in this study was reduced due to the limited number of stable flies that were available.

(Mosquitoes) Non-blood fed, adult female lab reared *Aedes albopictus* and *Culex quinquefasciatus* mosquitoes were caged and placed in a square 600 ft x 600 ft field plot that was treated with 6 aerial applications of Zenivex E20, which contains 20% etofenprox. 2 applications were made at the rate of 0.00175 lbs etofenprox per acre, 2 at the rate of 0.0035 lbs etofenprox per acre, and 2 at the rate of 0.007 lbs etofenprox per acre. The same flow rate of 83.8 ounces per minute at 30 PSI was used in all 6 applications. BVA-13 oil was used as a diluent to achieve application rates of 0.0035 and 0.00175 lbs etofenprox per acre. A target of 20-25 mosquitoes were loaded into cages, although an exact number of individuals used per cage was not given. For each application, 2 cages were mounted on each of 16 poles in the treatment zone for a total of 32 treated cages. The poles were arranged in a 4 x 4 array (4 cages per row and 4 cages per "column") separated from each other by 200 ft. A total of 4 control cages were placed on poles in the grid and removed 30 minutes prior to the start of each application. Only *Culex* mosquitoes were used in the low rate treatments.

Aerial ULV applications of Zenivex E20 were made perpendicular to the direction of the wind from a fixed wing aircraft at one of three application rates mentioned above. Due to rain during the week of the study, all planned applications were conducted on one night, with the exception of the second replicate at the 0.007 lbs etofenprox per acre, which was not conducted. Cages were left in the field plot for less than 30 minutes post application before removal and transfer to clean holding cups. Mortality was at recorded at four time points, the first occurring 1 hour post treatment and the final count occurring at approximately 24 hours post treatment. Untreated control mortality was also recorded. Slide spinners at each pole measured Volume Mean Diameter (VMD) of Zenivex E20 droplets.

Two successive aerial ULV applications of Zenivex E20 were made perpendicular to the direction of the wind from fixed wing aircraft at the rate of 0.00175 lbs etofenprox per acre on a single evening. Cages were left in the field plot for less than 30 minutes post application before removal and transfer to clean holding cups. Stable fly mortality was assessed 3, 13, and 22 hours after each application was made. Untreated control mortality was also recorded. Slide spinners at each pole measured Volume Mean Diameter (VMD) of Zenivex E20 droplets.

(3) **Results: (Stable Flies)** Results were reported in histogram form for each application. Raw data for every cage were not reported or provided. Mortality at the 22 hours post treatment endpoint was reported as 91%. Control mortality was not greater than 2%.

VMD of Zenivex E20 particles was reported as 21 and 30 microns for each application. These values fall within the label-specified range of 7-30 microns.

(Mosquitoes) Results were reported in histogram form for each application. Raw data were not provided. Reported mortality 24 hours post treatment
was greater than 90% in both replications for both species for the the 0.0035 lbs etofenprox per acre rate. At the lowest application rate of 0.00175 lbs per acre, mortality was greater than 90% in both *Aedes* replicates, but less than 90% in both *Culex* replicates. The reduced mortality is explainable due to less than ideal wind conditions and was confirmed by sub-optimal droplet densities in applications where >90% efficacy was not seen. At the lone 0.7 lbs etofenprox per acre application, reported mortality 24 hours post treatment was approximately 85% for *Aedes* and approximately 64% for *Culex*. The author explains that shifting wind conditions at the time of application caused the spray cloud to miss much of the target area, leading to reduced mortality from the expected. Low droplet densities confirm this.

An average VMD of 29 microns was reported. This falls within the label-specified range of 7-30 microns.

(4) **Conclusion:** This study is **acceptable** and supports efficacy claims against stable flies at the lowest label rate of 0.00175 lbs etofenprox per acre.

This study is **acceptable** and supports aerial ULV efficacy claims against *Ae. albopictus* and *Cx. quinquefasciatus* at the application rate of 0.0035 lbs etofenprox per acre. Aerial ULV efficacy claims against *Ae. albopictus* are also suppored at the low rate of 0.00175 lbs etofenprox per acre. Efficacy claims against *Cx. quinquefasciatus* are not supported at this rate because adequate efficacy was not demonstrated. However, the shifting winds causing the spray cloud to miss the target area do not prove that etofenprox at this rate is ineffective. The same can be said of the results seen in the 0.007 lbs etofenprox per acre application rate.

48255305. Field Aerial Mosquito Efficacy Studies of Etofenprox in Merced County, California.

(1) non-GLP.

(2) **Methods:** Feral, adult female *Ochlerotatus melanimon* and *Culex tarsalis* mosquitoes were collected with light traps at nearby locations and used in this study. Mosquitoes were caged and placed in a square 600 ft x 600 ft field plot that was to be treated with 6 aerial applications of Zenivex E20, which contains 20% etofenprox. Due to unfavorable weather conditions and aircraft issues, only two replications (one each at the 0.00175 and 0.0035 lbs etofenprox per acre application rates) were successfully completed. The same flow rate of 82 ounces per minute was used in both applications. Light mineral oil was used as a diluent to achieve desired application rates. A target of 20-25 mosquitoes (mixture of both species) were loaded into cages, although an exact number of individuals used per cage was not given. For each application, 2 cages were mounted on each of 16 poles in the treatment zone for a total of 32 treated cages. The poles were arranged in a 4 x 4 array (4 cages per row and 4 cages per "column") separated from each other by 200 ft. A total of 4 control cages were placed on poles in the grid and removed 30 minutes prior to the start of each application.

Aerial ULV applications of Zenivex E20 were made perpendicular to the direction of the wind from a fixed wing aircraft at one of the two application rates mentioned above. Two applications were attempted nightly over a span of three successive nights. Cages were left in the field plot for less than 30 minutes post application before removal and transfer to clean holding cups. Mortality was at recorded at four time points, the first occurring 1 hour post treatment and the final count occurring at approximately 24 hours post treatment. Untreated control mortality was also recorded. Slide spinners at each pole measured Volume Mean Diameter (VMD) of Zenivex E20 droplets.

(3) **Results:** Results were reported in histogram form for each application. Raw data were not provided. Reported mortality 24 hours post treatment
was 98% and 91% in the the groups treated with 0.0035 and 0.00175 lbs etofenprox per acre, respectively.

VMD of Zenivex E20 particles was 40 and 50 microns for the 0.0035 and 0.00175 lbs etofenprox per acre applications, respectively, which are outside the label-specified range of 7-30 microns for each application.

(4) Conclusion: Due to weather and mechanical problems and inadequate replication, this study is **supplemental**

and does not support ULV efficacy claims against *O. melanimon* and C*x. tarsalis* at the tested application rates of 0.0035 and 0.00175 lbs etofenprox per acre. The two species should not have been mixed together in the treatment cages, as genus-specific efficacy cannot be determined this way. It is likely that additional replicates and separation of test species would have demonstrated adequate efficacy based on the limited data submitted here.

48255306. Field Aerial Mosquito Efficacy Studies of Etofenprox in Brazos County, TX.

(1) non-GLP.

(2) **Methods:** Non-blood fed, adult female lab reared *Aedes albopictus* and *Culex quinquefasciatus* mosquitoes were caged and placed in a square 600 ft x 600 ft field plot that was treated with 6 aerial applications of Zenivex E20, which contains 20% etofenprox. 2 applications were made at the rate of 0.00175 lbs etofenprox per acre, 2 at the rate of 0.0035 lbs etofenprox per acre, and 2 at the rate of 0.007 lbs etofenprox per acre. The same flow rate of 80 ounces per minute at 44 PSI was used in all 6 applications. BVA-13 oil was used as a diluent to achieve application rates of 0.0035 and 0.00175 lbs etofenprox per acre. A target of 20-25 mosquitoes were loaded into cages, although an exact number of individuals used per cage was not given. For each application, 2 cages were mounted on each of 16 poles in the treatment zone for a total of 32 treated cages. The poles were arranged in a 4 x 4 array (4 cages per row and 4 cages per "column") separated from each other by 200 ft. A total of 4 control cages were placed on poles in the grid and removed 30 minutes prior to the start of each application. Only *Culex* mosquitoes were used in the low rate treatments.

Aerial ULV applications of Zenivex E20 were made perpendicular to the direction of the wind from a fixed wing aircraft at one of three application rates mentioned above. Two applications were attempted nightly over a span of three successive nights. Cages were left in the field plot for less than 30 minutes post application before removal and transfer to clean holding cups. Mortality was at recorded at four time points, the first occurring 1 hour post treatment and the final count occurring at approximately 24 hours post treatment. Untreated control mortality was also recorded. Slide spinners at each pole measured Volume Mean Diameter (VMD) of Zenivex E20 droplets.

(3) **Results:** Results were reported in histogram form for each application. Raw data were not provided. Reported mortality 24 hours post treatment
was greater than 90% in both replications for the the 0.007 and 0.0035 lbs etofenprox per acre rates. At the lowest application rate of 0.00175 lbs per acre, mortality was 98% in one replicate and 89% in the other. The reduced mortality is explainable due to less than ideal wind conditions. This field study reports mortality that is reasonably close to 90% and therefore supports efficacy claims.

An average VMD of 56 microns was reported. This falls outside the label-specified range of 7-30 microns.

(4) **Conclusion:** This study is **acceptable** and supports aerial ULV efficacy claims against *Ae. albopictus* and *Cx. quinquefasciatus* at the application rates of 0.007 and 0.0035 lbs etofenprox per acre. Aerial ULV efficacy claims against *Cx. quinquefasciatus* are also suppored at the low rate of 0.00175 lbs etofenprox per acre. Efficacy claims against *Ae. albopictus* are not supported at this rate because they were not included in those treatments.

48255307. Efficacy Determination of Ground ULV Applications of Etofenprox against Black Fly (*Simulium vittatum*).

(1) non-GLP

(2) **Methods:** Black flies (*Simulium vittatum*) were caged and placed in a 300 ft x 300 ft field plot that was treated with three different rates of Zenivex E20, which contains 20% etofenprox. A target of ten adult black flies per cage was reported, although an exact number of individuals used per cage was not given. Two cages were mounted on each of nine poles in the treatment zone for a total of 18 treated cages. The poles were arranged in a 3 x 3 array separated from each other by 100 ft. One control cage was placed on each pole and removed 30 minutes prior to the start of each treatment. .

ULV applications of Zenivex E20 were made from a truck-mounted sprayer travelling perpendicular to the wind

direction at 10 mph 100 ft from the nearest poles in the test plot. Single applications of three different rates (0.00175, 0.0035, and 0.007 lbs of etofenprox per acre) were made on the same day in succession from lowest to highest rate. Cages were left in the field plot for 15 minutes post application before removal. Black fly mortality was assessed 3, 12, and 24 hours after each application was made. Untreated control mortality was also recorded. Slide spinners at each pole measured Volume Mean Diameter (VMD) of Zenivex E20 droplets.

(3) **Results:** Mortality was averaged and reported as 95%, 97%, and 100%, respectively, after treatment with application rates of 0.00175, 0.0035, and 0.007 lbs of etofenprox per acre 24 hours post treatment. Raw mortality data were not provided. Control mortality was not greater than 7% for any one trial. Knockdown was not reported.

VMD of Zenivex E20 particles was reported as 19, 18, and 17 microns, respectively, for application rates of 0.00175, 0.0035, and 0.007 lbs of etofenprox per acre. These values fall within the label-specified range of 7-30 microns.

(4) **Conclusion:** This study is **acceptable** and supports efficacy claims against black flies at the rate of 0.00175, 0.0035, and 0.007 lbs of etofenprox per acre. Knockdown claims are not supported because these data were not collected. Quick kill/fast kill claims are also not supported as mortality was not assessed until 2-4 hours post treatment.

IV. EXECUTIVE DATA SUMMARY:

(A) The data support that this product kills black flies at the lowest label rate of 0.00175 lbs etofenprox per acre.

(B) The data support that this product kills stable flies at the tested rate of 0.00175 lbs etofenprox per acre.

(C) The data support that this product kills *Aedes* mosquitoes at the lowest label rate of 0.00175 lbs etofenprox per acre.

(D) The data support that this product kills *Culex* mosquitoes at the lowest label rate of 0.00175 lbs etofenprox per acre.

(E) No data to support aerial ULV efficacy claims against *Anopheles* mosquitoes were submitted.

V. LABEL RECOMMENDATIONS:

(1) No changes in the Directions for Use are suggested. Aerial ULV applications against mosquitoes (except *Anopheles* spp.) are supported by these data.

(2) The following marketing claims are acceptable:

Kills black flies
Kills stable flies
Kills biting flies
Kills Culex mosquitoes
Kills Aedes mosquitoes

(3) The following marketing claims are unacceptable:

Any knockdown claims regarding black flies
Any quick kill/fast kill claims regarding black flies

(4) The following MRIDs should be removed from the data matrix, as they are classified as "unacceptable" to support the product:

N/A

(5) Note to reviewer/PM:

The registrant still needs to submit data demonstrating efficacy of aerial ULV application against *Anopheles* mosquitoes, as stated originally in the DER dated 2/19/2009.

To obtain efficacy claims against biting flies, PERC currently requires data on a *Culicoides sp*., *Stomoxys calcitrans*, and one of either a *Simulium sp*. or *Prosimulium sp*. However, the DER dated 2/19/2009 states that only stable flies (*S. calcitrans*)need to be tested to achieve an efficacy claim against biting flies (see Section II above). The "biting flies" claim is supported by the data in this DER according to that guidance.

The study investigators conducted roughly the same study at 5 geographic locations within the United States, with each study taking place over the course of a week. The author of the studies states that weather conditions (wind/rain) often imposed severe limitations on the collection of efficacy data. In MRID 48255303, for example, only one replicate was able to be successfully conducted because of adverse weather conditions and equipment limitations. It is not surprising that less than ideal conditions were encountered given the logistical constraints.

ULV applications are highly dependent on favorable weather conditions to achieve efficacy against a target pest. Winds must be present, but light (~5mph), so that a spray cloud can drift into the target zone. Shifting winds, or winds below 5 mph, do not carry the spray cloud as effectively. This was often encountered by the study investigators. Therefore, the mortality figures against mosquitoes in this DER that are below 90% are to be expected if poor weather conditions are present, or if application equipment produces droplets that are of the incorrect diameter. In other words, while adequate efficacy was not demonstrated in all replicates, this can be attributed to unfavorable conditions that would ordinarily dictate that ULV operations not be conducted and **not** necessarily that the product is ineffective. Moreover, in those cases where favorable (or at least acceptable) weather conditions were observed, adequate efficacy was demonstrated at the lowest label rate of 0.00175 lbs etofenprox per acre. These are the dangers of time-limitations on a field study that is highly dependent on weather conditions.

TASK 2 DATA EVALUATION RECORD

STUDY TYPE: Product Performance

MRID 482553-04. Field Aerial Mosquito and Stable Fly Efficacy Studies of Etofenprox in Hamilton County, Iowa. Doug VanGundy, 2010.

OCSPP Product Performance Guideline: 810.3600

Product Name: Zenivex E20
EPA Reg. No. or File Symbol: 89459-81
Decision number: 509429
DP number: 429485

Prepared for
Registration Division (7505)
Office of Pesticide Programs
U.S. Environmental Protection Agency
Washington, DC 20460

Prepared by
Summitec Corporation
Task Order No.: 2-292

Primary Reviewer:
Dennis M. Opresko, Ph.D.

Signature: Dennis M. Opresko AS
Date: 11/10/2015

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Quality Assurance:
Angela M. Edmonds, B.S.

Signature: Angela M. Edmonds
Date: 11/10/2015

Disclaimer

This review may have been altered subsequent to the contractors' signatures above.
Summitec Corp. for the U.S. Environmental Protection Agency under Contract No. EP-W-11-014

EFFICACY STUDY DATA EVALUATION RECORD (COMPLETED STUDY) - Registration

Primary Reviewer's Name/Title:

STUDY TYPE:	PRODUCT PERFORMANCE [OCSPP GUIDELINE NO. 810.3600]
MRID:	482553-04. Field Aerial Mosquito and Stable Fly Efficacy Studies of Etofenprox in Hamilton County, Iowa. Doug VanGundy, 2010.
DP BARCODE:	429485
DECISION NO:	509429
SUBMISSION NO:	974692
SPONSOR:	WELLMARK INTERNATIONAL
TESTING FACILITY:	Iowa Mosquito Control, Rolfe, Iowa
STUDY DIRECTOR or INVESTIGATOR:	Doug VanGundy, Study Director
SUBMITTER:	Name illegible, Senior Regulatory Project Manager
STUDY COMPLETED:	11/06/2010
CONFIDENTIALITY CLAIMS:	No claim of confidentiality is made for any information contained in this study on the basis of falling within the scope of FIFRA section 10(d),(l),(A),(B),or (C).
GOOD LABORATORY PRACTICE:	This study does not meet the requirement of 40 CFR part 160 and differs in the following ways: This study was not in compliance under the following sections of 40 CFR part 160: **1**.160.35, **2**.160.47, **3**. 160.51, **4**. 160.81, **5**. 160.63, **6.** 160.105, **7**. 160.107, **8**.160.195.
TEST MATERIAL:	PRODUCT NAME: RF 2212 EC EPA REGISTRATION NUMBER OR FILE SYMBOL: 89459-81 ACTIVE INGREDIENT NAME: Etofenprox CHEMICAL NAME: 1 -[[2-(4-ethoxyphenyl)-2-methylpropoxy]methyl]-3-phenoxybenzene

A.I. %: 20%
PC CODE: Not reported
CAS NO.: 80844-07-1
FORMULATION TYPE: Spray
PRODUCT APPLICATION RATE(S): 0.00875 lbs to 0.035 lbs per acre
ACTIVE INGREDIENT APPLICATION RATE(S): 0.00175 to 0.0070 lbs. a.i. per acre (0.000196 g/m^2 to 0.000784596 g/m^2; reviewer calculated)

Efficacy Study Data Evaluation Record

Title: Field Aerial Mosquito and Stable Fly Efficacy Studies of Etofenprox in Hamilton County, Iowa

Purpose/Objective: To determine the efficacy of aerial application of etofenprox, formulated as Zenivex E20, against mosquitoes and stable flies.

Materials and Methods

Test Material(s):

- Product: Zenivex E20 containing 20% etofenprox; aerial spray. Applications were made using the following rates per the Zenivex label starting with the low rate and finishing with the high rate.

Table 1
Application rates

Treatment	Active Ingredient Concentration	Target Dose/ Application Rate
1	20% etofenprox	0.007 lbs a.i. per acre
2	20% etofenprox	0.0035 lbs a.i. per acre
3	20% etofenprox	0.00175 lbs a.i. per acre

Test Location: The test site was located at a small municipal airport in rural Hamilton County, Iowa.

Positive Control/Reference Standard, if used: None.

Species Tested:

- Common name and scientific name of each species. Mosquitoes: lab reared *Aedes albopictus* and *Culex quinquefasciatus.* Stable flies: lab-reared *Stomoxys calcitrans*
- Life stage as egg or nymph or larvae including stadia; or adult and sex and age. Mosquitoes: adult female, non-fed, 2-5 days old. Stable flies: adults (no other data)
- Describe the insecticide susceptibility status of the test population. Not reported

- Describe the origin of field collected strains. Not applicable
- If female adults are used - are they gravid? Not reported
- Describe rearing techniques. Not reported

Experiment description:

- List the treatments including the untreated control. Include a description of: Test arenas and/or apparatus (include site description and location): The test insects were exposed to aerial applications of the test product in a field environment. Mosquitoes and stable flies were contained in cages (as described by Townzen, 1973) on poles in a square grid established using 16 points in a four by four block with each point 200' apart to make a 600' by 600' grid. The poles were approximately 5' tall with 2' arms on either side. The site was open with few trees to obstruct the spray cloud. Each station was fitted with a battery powered spinner for monitoring droplet size and density. For each treatment the spinner was fitted with an arm in which two 3 mm by 76 mm Teflon™ coated slides were placed. Slides were removed and replaced for each treatment. Droplets were counted using the DropVision™ monitoring system.
- Method(s) of application: Aerial application by a Piper Aztec fixed wing aircraft equipped with two AU 5000 Micronair rotary atomizers. For the lower application rates, the Zenivex product was diluted with a compatible oil to keep the flow rates the same so as to keep the application consistent between the different application rates. Flight altitude was 100' and air speed was 138 MPH. Flow rates were established at 83.8 ounces per minute at 30 psi and a measured droplet size average of 29 μm (VMD). Applications were set to be perpendicular to the wind.
- Number of replicates per treatment: Two applications of the same rate were attempted for each of three successive nights for each of three application rates. For each treatment rate seventy-four cages of mosquitoes were prepared. A total of 36 cages were used for each application, 32 used in the treatments and four as untreated controls and two spares. The mosquitoes were split into separate cages, one housing *Culex* and the other housing *Aedes* for each pole. One cage of stable flies was prepared for each pole, A total of 18 cages were prepared for each application, 16 for exposure to the treatment and 2 for untreated control.
- Number of individuals per replicate: 20-25 mosquitoes per cage; a target number of 15 stable flies per cage.
- Length of exposure to treatment (time in seconds, minutes or hours): 30 minutes Controls were kept on the poles for 30 minutes prior to the start of exposures and then removed. The second replicate of the evening was run after completion of the first.
- Were tested specimens transferred to clean containers? Yes
- Experimental conditions (state relative humidity, temperature, and photoperiod): Weather data recorded included temperature, relative humidity, wind speed and direction.

Application Rate	0.00175a	0.00175b	0.0035a	0.0035b	0.007
Date	6/9/2010	6/9/2010	6/9/2010	6/9/2010	6/10/2009
Time of Application[1]	06:05	07:45	20:20	21:30	00:13
Ground Wind Speed[1]	3.6	3.4	2.6	2.4	1
Altitude Wind Speed[1]	n/a	n/a	n/a	n/a	n/a
Ground Wind Direction[1]	234°	256°	297°	323°	62°
Ambient Temperature(°C)[1]	15.8°	18.8°	24.4°	20.2°	18.8°
% Relative Humidity[1]	88	76	36	55	72

1. Reflects conditions at spray on time for each treatment. Wind speed values in MPH.

- The type of harborage if used in the experiment: Not applicable
- The data and/or endpoints that were recorded and how they were assessed (e.g., prodded with a needle to see if specimens move): Counts for mosquito mortality were made at differing intervals the following day with a final count approximately 24 hours following the initial application times.
- Report if morbidity and mortality were recorded separately: No
- Statistical analysis conducted and justification for selecting the approach to data analysis and statistics used (were data corrected to account for abnormalities in the data/study design, what level of significance was used, what were the confidence intervals around the mean value(s), was a median value also reported?):

  Percent mortality was derived by combining mortality of all cages within the grid per each application. Control mortality was adjusted using Abbott's formula.

  Mortality was calculated as follows:

$$\frac{\text{(Total number live mosquitoes in treated)}}{\text{(Total number of mosquitoes in treated)}} - 1 \times 100 = \%\ \text{mortality}$$

Abbott's formula

$$\frac{(X-Y)}{X} \times 100 = \%\ \text{Control}$$

X = % remaining alive in control
Y = % remaining alive in treated

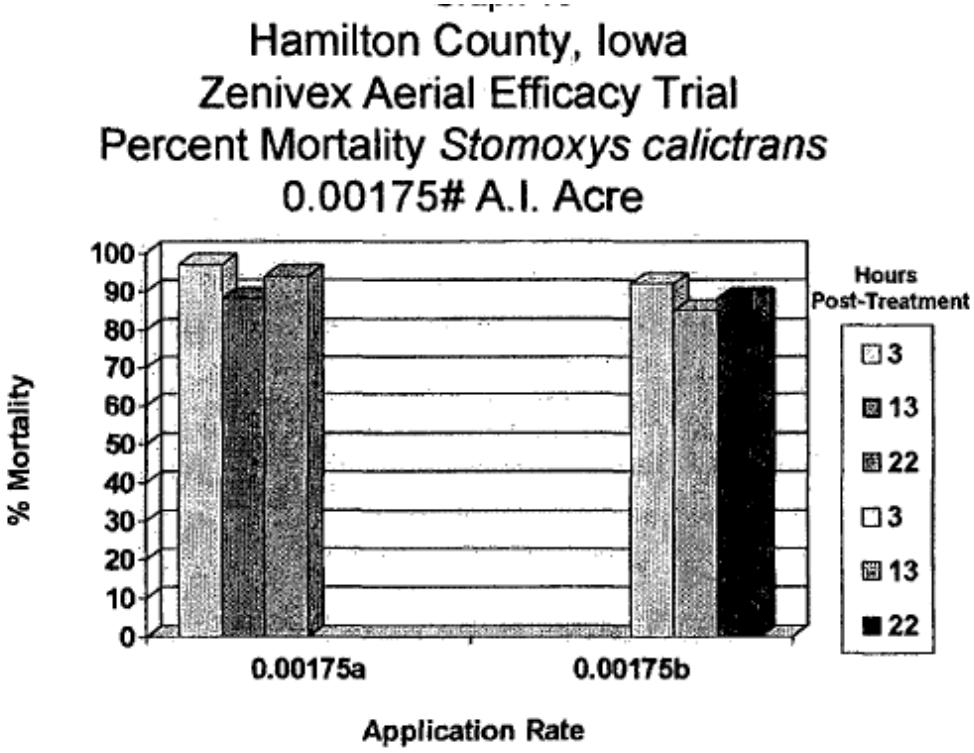
Data Reported/Results

This section of the review should include the following information from the study:

- Summary tables. Only mortality reported.

Combined Mosquito Percent Mortality at Final Data Point

Application Rate	0.00175a	0.00175b	0.0035a	0.0035b	0.007
Date	6/9/2010	6/9/2010	6/9/2010	6/9/2010	6/10/2010
Time of Application	06:05	07:45	20:20	21:30	0:13
Percent Mortality	84	84	99	95	75



Average Droplet density and Volume Median Diameter

Drop Collections	Treatments					
	0.007a	0.007b	0.0035a	0.0035b[2]	0.00175a	0.00175b
Average VMD[1]	34	N/A	24	N/A	21	30
Average Density[1]	1.2	N/A	3.6	N/A	3.2	1.4

1. Averages taken from readings of spinners from each pole, 32 slides total per treatment replicate.
2. Slide set for 0.0035b were defective, data not reported.

- If data were statistically analyzed make sure differences between treatments are clear and give P-value. Data not evaluated statistically.
- Deviations or amendments from the protocol: Due to unfavorable weather conditions all treatments were conducted on a single day, with the two replicates of the lowest treatment (0.00175 lbs per acre) conducted in the morning, and the two higher treatments conducted in the evening. Only one treatment at the highest rate was completed due to pilot fatigue. Winds varied and shifted during the last application of the evening which caused a reduction in expected efficacy at the highest rate. Stable flies were only used in the low application rate test (0.00175 lbs) due to insufficient numbers of flies.
- For each tested species, report the % efficacy (e.g. knockdown, mortality, repellency) for each treatment group. Include the following information, if applicable:
    - Timepoints (e.g., 4 h, 24 h) at which greater than 90% efficacy was observed. See below.
    - Tested a.i. application rate: 0.007 lbs, 0.0035 lbs, and 0.00175 lbs etofenprox per acre.
    - Surface tested, for residual studies (e.g. ceramic tile, wood panel): Not applicable
    - Formulation type (e.g. aerosol, granular): Liquid
    - Application type (e.g. direct, surface, area): Spray
    - Timepoints at which corresponding control mortality is greater than 10%: None

Conclusions

Control mortality was no greater than 2%. The test product was diluted with oil to facilitate application and to achieve the correct dilutions.

- Aerial application of 0.00175 lbs etofenprox per acre (average VMD = 21 and average droplet density 3.2 in first replicate, and 30 and 1.4. respectively, in the second replicate; units not reported) applied to caged *Culex quinquefasciatus* resulted in greater than 90% percent mortality at 1 hr post treatment in the first replicate, but less than 90% at 14 and 24 hr; and at all time periods (1, 12 and 20 hr) in the second replicate.

- Aerial application of 0.00175 lbs etofenprox per acre (average VMD = 21 and average droplet density 3.2 in first replicate, and 30 and 1.4. respectively, in the second replicate; units not reported) applied to caged *Aedes albopictus* resulted in percent mortality greater than 90% at all post treatment time periods in replicate 1 (1, 14, 20 hr) and in replicate 2 (1, 12 and 20 hr).

- Aerial application of 0.00175 lbs etofenprox applied to caged *Aedes albopictus* and *Culex quinquefasciatus* resulted in combined percent mortality of 84% and 84% for the two replicates 22 hr post treatment.

- Aerial application of 0.0035 lbs etofenprox per acre (average VMD = 24 and average droplet density 3.6 in first replicate and not recorded in the second replicate; units not reported) applied to caged *Culex quinquefasciatus* resulted in greater than 90% percent mortality at all post treatment time periods in the first replicate (3, 12 and 23 hr), and in the second replicate (2, 12 and 23 hr).

- Aerial application of 0.0035 lbs etofenprox per acre (average VMD = 24 and average droplet density 3.6 in first replicate, and not recorded in the second replicate; units not reported) applied to caged *Aedes albopictus* resulted in greater than 90% percent mortality at all post treatment time periods in the first replicate (3, 12 and 23 hr), and in the second replicate (2, 12 and 23 hr).

- Aerial application of 0.0035 lbs etofenprox per acre applied to caged *Aedes albopictus* and *Culex quinquefasciatus* resulted in combined percent mortality of 99% at 22 hr post treatment for first replicate and 95% at 19 hr post treatment for second replicate.

- Aerial application of 0.007 lbs etofenprox per acre (average VMD = 34 and average droplet density 1.2 in first replicate; units not reported) applied to caged *Culex quinquefasciatus* resulted in less than 90% percent mortality at all times post-treatment (3, 13 and 22 hr).

- Aerial application of 0.007 lbs etofenprox per acre (average VMD = 34 and average droplet density 1.2 in first replicate; units not reported) applied to caged *Aedes albopictus* resulted in less than 90% percent mortality at all post treatment time periods (3, 13 and 22 hr).

- Aerial application of 0.007 lbs etofenprox applied to caged *Aedes albopictus* and *Culex quinquefasciatus* resulted in combined percent mortality of 75% at 22 hr post treatment (only one treatment).

- Aerial application of 0.00175 lbs etofenprox (average VMD = 21 and 30 and average droplet density 3.2 and 1.4 for replicates 1 and 2 respectively; units not reported) applied to caged stable flies resulted in percent mortality greater than 90% at 3 and 22 hr post treatment in the first replicate (but not at 13 hr) and at 3 hr in the second replicate (but not at 13 and 22 hr).

TASK 2 DATA EVALUATION RECORD

STUDY TYPE: Product Performance

MRID 482553-07. Efficacy determination of Ground ULV Applications of Etofenprox Against the Black fly (*Simulium vittatum*). Doug VanGundy, 2010.

OCSPP Product Performance Guideline: 810.3600

Product Name: Zenivex E20
EPA Reg. No. or File Symbol: 89459-81
Decision number: 509429
DP number: 429485

Prepared for
Registration Division (7505)
Office of Pesticide Programs
U.S. Environmental Protection Agency
Washington, DC 20460

Prepared by
Summitec Corporation
Task Order No.: 2-292

Primary Reviewer:
Dennis M. Opresko, Ph.D.

Signature: Dennis M. Opresko AB
Date: 11/10/2015

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Robert H. Ross, M.S. Program Manager

Signature: Robert H. Ross AB
Date: 11/10/2015

Quality Assurance:
Angela M. Edmonds, B.S.

Signature: Angela M. Edmonds
Date: 11/10/2015

Disclaimer

This review may have been altered subsequent to the contractors' signatures above.
Summitec Corp. for the U.S. Environmental Protection Agency under Contract No. EP-W-11-014

EFFICACY STUDY DATA EVALUATION RECORD (COMPLETED STUDY) - Registration

Primary Reviewer's Name/Title: _____

STUDY TYPE:	PRODUCT PERFORMANCE [OCSPP GUIDELINE NO. 810.3600]
MRID:	482553-07. Efficacy determination of Ground ULV Applications of Etofenprox Against the Black fly (*Simulium vittatum*). Doug VanGundy, 2010.
DP BARCODE:	429485
DECISION NO:	509429
SUBMISSION NO:	974692
SPONSOR:	WELLMARK INTERNATIONAL
TESTING FACILITY:	Chambers County Vector Control Anahuac, Texas
STUDY DIRECTOR or INVESTIGATOR:	Doug VanGundy, Study Director
SUBMITTER:	Name illegible, Senior Regulatory Project Manager
STUDY COMPLETED:	3/06/2010
CONFIDENTIALITY CLAIMS:	No claim of confidentiality is made for any information contained in this study on the basis of falling within the scope of FIFRA section 10(d) (1) (A) (B) or (C)
GOOD LABORATORY PRACTICE:	This study does not meet the requirement of 40 CFR part 160 and differs in the following ways: This study was not in compliance under the following sections of 40 CFR part 160: **1**.160.35, **2**.160.47, **3**. 160.51, **4**. 160.81, **5**. 160.63, **6.** 160.105, **7**. 160.107, **8**.160.195.
TEST MATERIAL:	PRODUCT NAME: RF 2212 EC EPA REGISTRATION NUMBER OR FILE SYMBOL: 89459-81 ACTIVE INGREDIENT NAME: Etofenprox CHEMICAL NAME: 1 -[[2-(4-ethoxyphenyl)-2-methylpropoxy]methyl]-3-phenoxybenzene

A.I. %: 20%

PC CODE: Not reported

CAS NO.: 80844-07-1

FORMULATION TYPE: Spray (product is diluted with water for lower application rates)

PRODUCT APPLICATION RATE(S): 0.00875 lbs to 0.035 lbs per acre

ACTIVE INGREDIENT APPLICATION RATE(S): 0.00175 to 0.0070 lbs. a.i. per acre (0.000196 g/m^2 to 0.000784596 g/m^2; reviewer calculated).

Efficacy Study Data Evaluation Record

Title: Efficacy determination of Ground ULV Applications of Etofenprox Against the Black fly (*Simulium vittatum*).

Purpose/Objective: To determine the efficacy of etofenprox formulated as Zenivex E20 against Black fly (*Simulium vittatum*) when applied from ground ULV equipment.

Materials and Methods

Test Material(s):

Product: Zenivex E20 containing 20% etofenprox; ground ULV spray. The three label rates of Zenivex E20; 0.007#, 0.0035#, 0.00175# A.I. per acre were scheduled for testing. The Zenivex product was diluted with BVA-13 oil to facilitate application and to dilute the product for the lower application rates.

Application rates

Treatment	Active Ingredient Concentration	Target Dose/ Application Rate
1	20% etofenprox	0.007 lbs a.i. per acre
2	20% etofenprox	0.0035 lbs a.i. per acre
3	20% etofenprox	0.00175 lbs a.i. per acre

Test Location: The test site was located at the Chambers County, Texas municipal airport.

Positive Control/Reference Standard, if used: None.

Species Tested:

- Common name and scientific name of each species. Black flies (*Simulium vittatum)*
- Life stage as egg or nymph or larvae including stadia; or adult and sex and age. Adult females, lab reared

- Describe the insecticide susceptibility status of the test population. Not reported
- Describe the origin of field collected strains. Not applicable, lab reared
- If female adults are used - are they gravid? Not reported
- Describe rearing techniques. Not reported

Experiment description:

- List the treatments including the untreated control. Include a description of: Test arenas and/or apparatus (include site description and location): Black flies were exposed to ground ULV applications of the test product in a field environment. The insects were contained in cages (as described by Townzen, 1973) on poles in a square grid established using 9 points in a three by three block with each point 100' apart to make a 300' by 300' grid. The driveline path was offset 100' parallel to the first line of poles and upwind to allow proper drift across the treatment block. The driveline was 1000' long with the centermost pole placed in the center most of the drive line, i.e. the center pole was placed at the 500' point in the drive line. Applications were made perpendicular to the wind. The poles were approximately 5' tall with 2' arms on either side. These arms were used for attaching the exposure cages containing the Black flies. On the center of each pole a motorized spinner was placed. This spinner was used for placing Teflon™ coated slides for droplet measurements. Droplet measurements were conducted using an AIMS DCIII droplet analyzer. The VMD was 2.59 microns at 14 feet. The Zenivex product was diluted with BVA-13 oil to facilitate the applications.
- Method(s) of application: Ground ULV spraying from the back of a pick-up truck using a Guardian 190 ES with Accu-Flow. Ground speed of the truck when driven over the driveline was 10 mph. Flow rate of the fogging unit was established at 10.78 ounces per minute of solution.
- Number of replicates per treatment: two cages per pole with nine poles on the grid
- Number of individuals per replicate: flies per cage: target number 10 per cage
- Length of exposure to treatment (time in seconds, minutes or hours): 15 minutes. Control cages were kept on the poles for 30 minutes prior to the start of exposures and then removed.
- Were tested specimens transferred to clean containers? Yes
- Experimental conditions (state relative humidity, temperature, and photoperiod): Weather data recorded included temperature, relative humidity, wind speed and direction.

Application Rate	0.00175	0.0035	0.007
Date	6/2/2010	6/2/2010	6/2/2010
Time of Application[1]	20:50	21:30	22:10
Ground Wind Speed[1]	2.1	3.2	2.6
Ground Wind Direction[1]	156°	158°	197°
Air Temperature(°C)[1]	27°	27°	27°
Ground Temperature(°C)[1]	27°	27°	27°
% Relative Humidity[1]	80	82	82

1. Reflects conditions at spray on time for each treatment. Wind speed values in MPH.

- The type of harborage if used in the experiment: Not reported
- The data and/or endpoints that were recorded and how they were assessed (e.g., prodded with a needle to see if specimens move): Not reported
- Report if morbidity and mortality were recorded separately: No
- Statistical analysis conducted and justification for selecting the approach to data analysis and statistics used (were data corrected to account for abnormalities in the data/study design, what level of significance was used, what were the confidence intervals around the mean value(s), was a median value also reported?): Not applicable

  Percent mortality was derived by combining mortality of all cages within the grid per each application. Control mortality was adjusted using Abbott's formula.

  Mortality was calculated as follows:

  % mortality calculations

  $$\frac{\text{(Total number live in treated)}}{\text{(Total number in treated)}} - 1 \times 100 = \%\ \text{mortality}$$

  Abbott's formula

  $$\frac{(X-Y)}{X} \times 100 = \%\ \text{Control}$$

  X = % remaining alive in control
  Y = % remaining alive in treated

Data Reported/Results

This section of the review should include the following information from the study:

- Summary table. Only mortality reported (see table below)

Percent Mortality at Final Data Point

Application Rate	0.00175	0.0035	0.007
Application Date	6/2/2010	6/2/2010	6/2/2010
Time of Application	20:50	21:30	22:10
Percent Mortality	95	97	100

Average Droplet Density and Volume Median Diameter

Drop Collections	Treatments		
	0.00175	0.0035	0.007
Average VMD[1]	19	18	17
Average Density[1]	30	13	22
Average Drops Collected[1]	419	282	394

1. Averages taken from readings of spinners from each pole, 18 slides total per treatment group.

- If data were statistically analyzed make sure differences between treatments are clear and give P-value. Data not evaluated statistically. Data not evaluated statistically.
- Deviations or amendments from the protocol: Due to the limited number of Black flies available for testing the number of replicate treatments was restricted to one treatment for each labeled rate.
- For each tested species, report the % efficacy (e.g. knockdown, mortality, repellency) for each treatment group. Include the following information, if applicable:
    - Timepoints (e.g., 4 h, 24 h) at which greater than 90% efficacy was observed. See below.

- Tested a.i. application rate: 0.007 lb, 0.0035 lb, and 0.00175 lbs etofenprox per acre.
- Surface tested, for residual studies (e.g. ceramic tile, wood panel): Not applicable
- Formulation type (e.g. aerosol, granular): Liquid
- Application type (e.g. direct, surface, area): ULV spray
- Timepoints at which corresponding control mortality is greater than 10%: None

Conclusions

Control mortality was not greater than 7% for any one treatment. Test product was diluted with BVA-13 oil to achieve the desired lower application rates.

- Ground ULV application of 0.00175 lbs etofenprox per acre (average VMD = 19; droplet density 30; units not reported) applied to caged Black flies resulted in percent mortality greater than 90% at 4, 14 and 24 hours post treatment.

- Ground ULV application of 0.0035 lbs etofenprox per acre (average VMD = 18, droplet density 13; units not reported) applied to caged Black flies resulted in percent mortality greater than 90% at 2, 13 and 24 hours post treatment.

- Ground ULV application of 0.007 lbs etofenprox per acre (average VMD = 17, droplet density 22; units not reported) applied to caged Black flies resulted in percent mortality greater than 90% at 3, 12 and 24 hours post treatment.